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A Singaporean Study on Macroeconomic Variables Impacting Stock Returns

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Abstract

Stock market returns has increasingly become a leading indicator of a country's economic performance. This explains academia's growing interest in determining factors affecting stock returns. A majority of recent studies on Singapore's economic performance focused centrally around policy impact or property prices, and not specifically on stock returns. This study aimed to fill this gap, by examining if, and how, historical movements in the Straits Times Index (STI) were explained by the S$NEER, Monetary Supply, CPI, Balance of Payments, Crude Oil Prices, Electricity Generated, GFCF, Industrial Production, Merchandise Trade, or Labour Cost. By utilizing a Structural Vector Auto regression (SVAR) Model, approximately 48% of the STI's variance was collectively attributable to these ten macroeconomic variables, all of which had short-term impact on the STI. Looking forward, further research could be conducted examining the impact of said variables on individual sectoral stock indices, for greater insight on the dynamics of their relationships.

Keywords: Finance, Econometrics, Structural Vector Auto regression, Stock Returns, Singapore

1. Introduction

Warren Buffett, renowned investor in recent decades and owner of investment company Berkshire Hathaway, was noted to turn to an unorthodox indicator for valuing companies, i.e. comparing a country's total stock market capitalization to that country's GDP (Reese, 2016). Dubbed the "Buffett Indicator", this ratio was intended to suggest that stocks in a certain country were undervalued at lower levels, and overvalued at higher levels (Li, 2017; Reese, 2016). As such, this indicator made headlines recently as it showed that levels for the US market was heading close to its peak right before the dot-com bubble of 2000; suggesting that a possible bearish turn in the market is approaching (Li, 2017).

Chang and Pak (2017) found this Indicator to be reliable for some, not all countries, with Singapore being one of the countries in which the Indicator could be used to reliably compare countries' stocks for better returns. At the same time, other than Hong Kong, Singapore's Buffett Indicator score of over 200% of GDP is the highest in comparison with its trade partners such as Malaysia (130%), China (70%), Indonesia (40%), the European Union (45%), and the US (150%), or the global average of approximately 95%; Hong Kong aside (over 1,000%) (Ministry of Trade and Industry, 2017; WorldBank, 2017).

However, in the spirit of thorough due diligence before investing, a single Technical Indicator is insufficient in coming to a conclusion on Singapore's Stock Returns. As such, this Research aims to impart a more thorough understanding of how macroeconomic factors affect stock returns, with a focus on Singapore's climate. The main objectives of this research are:

- To determine the effect of Macroeconomic variables on stock returns in Singapore, by using changes in the Straits Times Index price as a basis of determining stock returns.
- To determine the extent to which Macroeconomic variables explain the differing stock returns in Singapore.

2. Literature Review

2.1 Macroeconomy and Stock Returns

Alam and Rashid (2014) noted that stock market returns has grown to be a leading indicator of a country's economic performance. This explains why there has been academic interest in determining factors which affect such returns, both in the long and short run. However, given that studies focus on different countries, with different economic climates, as well as differing time periods, there have been several similar findings, as well as dissimilar ones.

Kurniawati et al. (2016) examined the short-term impact of macroeconomic variables on overall Indonesian stock returns, and Indonesian sectoral index stock returns. A Structural Vector Autoregression (SVAR) model was constructed to determine the relationships between the Jakarta Composite Index (JCI) and several sectoral indices, with macroeconomic variables such as Exchange rate (vs USD), Inflation, Oil, Gold, Interest rates, Monetary Supply, Fiscal Deficit, Government Debt and Trade Balances.

This study yielded findings that suggest Oil and Gold prices have a positive effect on agricultural and mining stock returns, while Interest rates have a negative impact on the JCI,

and that Exchange rates have a negative effect on the JCI and all other indices except for Mining. Country-specific economic factors were noted to account for these findings. Indonesia's economy does include significant oil palm agricultural activity and that of Gold mining; hence fluctuations in the price of such products do have a positive linear impact on stock returns. The study also suggested that Interest rates' negative impact on returns were attributable to the fact that a higher interest rate means a higher cost of debt, hence affecting a firm's profitability and in turn lowering stock returns; thereby indirectly suggesting there being a norm for Indonesian firms to have a high debt/leverage. As for the negative impact that Exchange rates have on stock returns, it was explained that a depreciation of domestic currency decreases the relative price of exports from a second country's perspective, hence increasing the volume of exports from Indonesia, leading to increased profits and in turn higher stock returns for export-oriented firms (Kurniawati et al., 2016).

Ravnik and Zilic (2011) used an SVAR model to investigate the short-run impact of fiscal policy on Croatian inflation, short-term interest rates, and economic activity. In Croatia, a country that was noted to have a pro-cyclic and expansive fiscal policy, one notable finding this study made was that government expenditure shocks had a negative short-term impact on industrial production, which the study used as a proxy for economic activity. This was unexpected as the study had previously expected government expenditure to have a positive effect on industrial production (i.e. economic activity) (De Arcangelis and Lamartina, 2003; Perotti, 2002; Ravnik and Zilic, 2011); in other words indirectly implying an expected increase in stock returns.

Kuwornu (2012) studied the impact of macroeconomic variables on stock returns in Ghana. A different methodology, the Johansen Multivariate Co-integration Procedure, was used on the following variables: the Consumer Price Index (CPI; as a proxy for inflation), Crude Oil prices, the Exchange rate, and 91-day T-Bill rates (proxy for interest rate); to determine their relationships with the Ghana Stock Exchange All Share Index (i.e. stock returns). As Ghana was noted to be a country in which investors perceive interest rates to be "alternative investment opportunities" (Kuwornu, 2012), increases in Interest rates lead to decreases in equities investments. This explained the findings of a negative short-term relationship between the two. Ghana was also noted to be a net importer of oil, Crude oil prices are considered a production cost to economic activities; hence a negative correlation finding with stock returns. Contrary to Indonesia, a net exporter (Kurniawati et al., 2016), Ghana is a net importer; hence explaining the positive effect Exchange rate has on economic activity, and in turn, stock returns (Kuwornu, 2012).

Alam and Rashid (2014) went a step further by considering conditional heteroskedacity, by investigating the relationship that macroeconomic variables shares with the Karachi Stock Market 100 Index in Pakistan. By using a GARCH (Generalized Autoregressive Conditional Heteroskedasity) Model, it was found that the Consumer Price Index, Money Supply, Exchange Rates and Interest rates had a negative relationship with Stock returns, while Industrial Production had a positive relationship with Stock returns, and Inflation had an inconsistent negative relationship with the latter. The study had noted that it was attributable to the fact that in Pakistan, an export-oriented country, stocks are not popular investment choices. Money Supply was also found to only influence stock returns via Inflation. This

study also noted that this market saw concentrated shareholdings, and with the lack of popularity in stock investments, there was little noted incentive for informational and operational efficiency, explaining its low liquidity (Alam and Rashid, 2014).

Chia and Lim (2015) used an Autoregressive Distributed Lag (ARDL) Bounds Test to examine responses in the Malaysian Share Price Index to Industrial Production, Inflation, Monetary Supply, Interest rate and Exchange rate. This study found that CPI had a negative relationship with stock returns, and an increase in Money Supply was found to increase stock returns. This was rationalized by the suggestion of portfolio theory that a greater money supply leads to a move from non-interest bearing to interest-bearing, such as stocks (Chia and Lim, 2015). Exchange rates were also cited in this study as theoretically influencing stock prices, as the Malaysian economy is export-oriented.

2.2 Singapore's Economy and Stock Returns

Ali et al. (2014) examined the impact of monetary and fiscal policies' shocks to housing prices in Singapore, via SVAR Modelling. This same approach was used to determine the effects of the same policies, along with other macroeconomic factors including gold prices, oil prices, exchange rates and government expenditure on stock returns. This study found that Stock returns had a positive reaction to Oil prices and Government expenditure (proxy for fiscal policy), and negative to Exchange rates and Gold prices, but none to Housing prices. Gold and Oil prices were also found to have negative impacts on Exchange rates.

Singapore is a net exporter overall, with nearly 70% of its exports being merchandise (with the rest being Services), and neither of which is in Gold (Ministry of Trade and Industry, 2017). As such, it would be unsurprising that Exchange rates and Gold prices negatively impact Stock returns, and that Gold and Oil prices negatively impact the Exchange rate (Ali et al., 2014). However, given that Singapore's Oil & Gas sector remains a significant part of the local economy, it accounted for the positive relationship between Oil prices and Stock returns in Singapore.

However, there are several other notable macroeconomic factors relevant to Singapore that warrant discussion as well. Firstly, given that Singapore is more abundant in labour than in natural resources (e.g. Oil, Gold etc.), the cost of labour would in fact be relevant in playing a part to influence Stock returns locally; especially so since it forms up to over 40% of business costs in Singapore (Ministry of Trade and Industry, 2017). In fact, given that Unit Labour Cost rose faster than Labour Productivity Gains (Ministry of Trade and Industry, 2017), this rise in labour cost should have a negative impact on Stock returns.

Secondly, close to if not all reviewed studies used the USD as their benchmark for Exchange rates. There was however no mention of whether this benchmark was justified by the US being the base country's most significant trade partner. In Singapore's context, the US is the 4th largest merchandise trade partner, but does not make the top 5 export destinations in 2016 (Ministry of Trade and Industry, 2017). As such, a benchmark purely against the USD may not be a reliable indicator of the strength of Singapore's currency. One possible measure would be the Singapore-dollar Nominal Effective Exchange Rate (S$NEER), which benchmarks the SGD against a basket of currencies; weightage of which takes into

consideration the base country's trade partnerships (International Monetary Fund, 2006). As with the above-mentioned studies, as Singapore is a net exporter, it is hypothesized that Exchange rates (i.e. S$NEER) has a negative impact on Stock returns.

While still on the topic of trade, given the importance of manufacturing and import/exports to Singapore's economy, both Total Industrial Production and Total Merchandise Trade shall also be taken into consideration for this research; with the hypotheses that both have positive impacts on Stock returns.

At the same time, Arora and Lieskovsky (2014) investigated the idea of using measures of electricity usage as an indicator of economic activity. This study found that in the US, electricity usage was a strong indicator of activity in the economy. Total Retail Electricity Sales would not only cover manufacturing, but also services and other activities in general, whether supported by or as a product of economic activity (Arora and Lieskovsky, 2014). As such, we hypothesize that in Singapore, Total Electricity Generated (the proxy of the equivalent), has a positive impact on Stock returns.

Next, studies such as Alam and Rashid (2014) and Kuwornu (2012) took into consideration CPI as a proxy for inflation. The CPI fell by 0.5% in 2016; in spite of increasing overall prices of recreation, healthcare, food and education, the decline was attributed to decreases in transport, accommodation and utilities prices (Ministry of Trade and Industry, 2017). As with both previously-discussed studies, should inflation decrease, stock returns would hypothetically increase.

As also seen in the above studies, the Government plays a significant role in boosting the economy, via fiscal and monetary policies. As such, Monetary Supply shall also be taken into consideration. In line with the findings of Kurniawati et al. (2016) and Chia and Lim (2015), it is hypothesized that Singapore's Monetary Supply has a positive impact on Stock returns.

Even though their results showed otherwise, Ravnik and Zilic (2011) hypothesized that Croatian government expenditure would have a positive effect on industrial production (i.e. economic activity), and in turn be positive on domestic Stock returns. Ali et al. (2014), however, yielded results in Singapore context for this same hypothesis. With the Balance of Payments as a proxy for Government expenditure, this same hypothesis shall be undertaken.

Lastly, Gross Fixed Capital Formation (GFCF) is also recognized as a key performance indicator of Singapore's economy (Ministry of Trade and Industry, 2017). GFCF measures the overall changes in fixed assets for the different sectors in a country; being understood to have a positive relationship with economic strength (Ministry of Trade and Industry, 2017). As such, it shall be hypothesized that GFCF has a positive impact on Stock returns.

2.3 The Structural Vector Autoregression ('SVAR') Model

2.3.1 VAR Models

With a growing popularity in recent decades, a Vector Autoregression (VAR) Model is a time-series analysis tool which has several similar characteristics to large-scale simultaneous equation models, is in fact a systems regression model (Brooks, 2014; Gottschalk, 2001; Luetkepohl, 2011). In other words, it analyses several variables at once, and determines the relationships between them, even if more than one of these variables are dependent variables

(Brooks, 2014; Gottschalk, 2001; Luetkepohl, 2011).

2.3.2 Benefits of VAR Modelling

Firstly, all variables are considered to be endogenous in a VAR Model. This means that exogeneity of any variables need not be defined; hence shortening the Model construction process (Brooks, 2014).

Secondly, as VAR models capture the values of variables which are attributed to both its Lags and white noise terms (as do Univariate AR models), these models are able to offer more information on causation, while being able to handle data with higher frequency (Brooks, 2014; Luetkepohl, 2011).

2.3.3 Drawbacks & Limitations of VAR

Firstly, the appropriate Lag lengths must be determined in order to construct the VAR model, or the interactions between the variables will not be interpreted reliably by the Model (Brooks, 2014).

Secondly, all the variables must satisfy the stationarity condition in order for their coefficients to be statistically significant for hypothesis testing (Brooks, 2014). Also according to Brooks (2014), stationarity can be induced via Differencing the values, but this would reduce the amount of insight the Model could provide with regards to long-run relationships between the variables.

Thirdly, given that VARs do not rely heavily on the theoretical information behind potential relationships between the variables, VAR coefficient estimate values do not have one consistent method of interpretation; hence making VAR models nearly impossible to interpret, especially in their reduced-form (Brooks, 2014; Gottschalk, 2001).

On the other hand, by running the appropriate Lag length test, variable stationarity tests and implementing contemporaneous structural restrictions to the VAR Model (i.e. Structural VAR / SVAR), the downsides to using a VAR model are reduced.

3. Research Hypotheses

1. S$NEER has a negative impact on STI
2. Monetary Supply has a positive impact on STI
3. CPI has a negative impact on STI
4. Balance of Payments has a positive impact on STI
5. Crude Oil Prices has a positive impact on STI
6. Electricity Generated has a positive impact on STI
7. Gross Fixed Capital Formation has a positive impact on STI
8. Total Industrial Production has a positive impact on STI
9. Total Merchandise Trade has a positive impact on STI
10. Unit of Labour Cost has a negative impact on STI

4. Research Methodology

4.1 Data Description

To investigate these hypotheses, the following Quarterly data was gathered:

Variable	Unit	Remarks	Source
S$NEER	Index	Base Jan 1999 = 100; Average Week Ending Figures	Department of Statistics, Singapore
Monetary Supply	SGD	M1+M2+M3 in Million Dollars	Department of Statistics, Singapore
Consumer Price Index	Index	Base Year 2014 = 100	Department of Statistics, Singapore
Balance of Payments	SGD	BPM6 Format; Overall Balance in Million Dollars	Department of Statistics, Singapore
Crude Oil Price	USD/Barrel		WorldBank
Electricity Generated	Gigawatt Hours	Dec 2016 figure was estimated	Department of Statistics, Singapore
Gross Fixed Capital Formation	SGD	2010 Market Prices in Million Dollars	Department of Statistics, Singapore
Total Industrial Production	Index	Base Year 2015 = 100	Department of Statistics, Singapore
Total Merchandise Trade	SGD	2012 Prices in Thousand Dollars	Department of Statistics, Singapore
Unit of Labour Cost	Index	Base Year 2010 = 100	Department of Statistics, Singapore
FTSE Straits Times Index	SGD		Bloomberg

4.1.1 Electricity Generated

As the data for Dec 2016 was unavailable at the time of information retrieval, the figure was estimated to be 4,210 Gigawatt Hours by taking into consideration the existing, as well as seasonal, trends from Jan 2010-Dec 2016.

4.1.2 Differing Base Years & Market Prices

It was noted that the data had differing base years for indices and market prices. However, as illustrated by Luetkepohl (2011), given that the SVAR model measures reactions to structural shocks, the input data for analysis shall be the Differences of these data points, e.g. the first value for Crude Oil prices shall be derived by subtracting the Price in March 2010 from the Price in June 2010. Differencing the values and using First Difference values would also induce stationarity, which would not be an issue since long-run relationships will not be examined in this Research (Brooks, 2014; Gottschalk, 2001).

4.2 Methodology

All statistical analyses were done via EViews 9.

4.2.1 Pre-estimation

The following Pre-estimation Tests were carried out, and for the following purposes:

The Unit Root Test, which determines the Stationarity of variables.

The Lag Order Selection Criteria, which determines the optimal Lag for the VAR model, via Schwarz Information Criterion.

The VAR Stability Test, which shall determine if the range of modulus values generated based on the VAR Model's Equation for the STI shall allow the VAR Model to be in a stable state.

4.2.2 SVAR

An AB-model SVAR model was constructed to validate the hypotheses. More specifically, an AB-model approach shall be utilized to structure the SVAR.

Amisano and Giannini (1996) describe and document evidence that it is required for a VAR model to be considered in its reduced form, in which the variables' instantaneous relations are not only unexplained, but also unapparent when uninterpreted. The reduced form of the Model is also required in order to utilize the appropriate Choleski factor for variance decomposition at the later stage of this analysis (Amisano and Giannini, 1996). As such, the reduced-form VAR Model is expressed as the following:

$$y_t = A_1\ y_{t-1} + \ldots + A_p\ y_{t-p} + B\ x_t + \varepsilon_t \quad (1)$$

Within this Model comprising of K endogenous variables, y_t is a K vector of endogenous variables, p refers to the order of the variables in the VAR model, x_t is a vector of exogenous variables, and ε_t is a possibly-contemporaneously correlated vector of structural disturbances that are uncorrelated with their own lagged values, as they are uncorrelated with those of the right-hand side variables. A and B refer to matrices of coefficients to be estimated.

4.2.3 Contemporaneous Restrictions

Working with the assumption that structural innovations within this Model are orthogonal, structural restrictions of contemporaneous nature are applied to the VAR model. Without applying these restrictions, it is impossible to draw conclusions from the reduced-form VAR (Gottschalk, 2001). The expression of the SVAR model, with the restrictions applied, are as follows:

$$A\ e_t = B\ u_t \quad (2)$$

The notation e_t refers to a $(k * 1)$ matrix of the reduced-form residuals, while u_t is a $(k * 1)$ matrix of unobserved structural innovations. A and B are $(k * k)$ invertible matrices, where A is the identity matrix, and B is a diagonal matrix. These matrices are imposed on by a set of $k(k+1)/2$ non-linear restrictions, leaving $2k^2$-$k(k+1)/2$ free elements.

Although Kurniawati et al. (2016) utilized a C-Model SVAR with long-run restrictions to examine the effects of macroeconomic variables on stock returns, an AB-Model was selected

in spite of the C-Model's benefits. The C-Model is structured such that the endogenous variables have no relationships specified; rather, the impact of set orthonormal disturbances are explicitly specified in the C matrix instead (Amisano and Giannini, 1996; Gottschalk, 2001). However, the premise of the construction of a C matrix as a square matrix has a limitation, in that it is assumed that the number of equations in the matrix is equal to the number of orthonormal disturbances, in spite of having a lack of theoretical reason to assume so (other than as a convenient assumption). The implications in doing so are that there is the assumption that a majority of, if not all, the causes for orthonormal shocks to the Model are accounted for; hence potentially skewing the Model's results and not being aware of this bias even with hindsight.

On the other hand, an AB-model functions such that the nature of its restrictions imposed on the SVAR model allows this model to explicitly determine links between the endogenous variables, while also providing insight into the effect that orthonormal random shocks have on the variables (Amisano and Giannini, 1996; Gottschalk, 2001). In addition, given that only Quarterly data spanning 17 years was obtained, imposing short-run restrictions was a more conservative option.

5. Results and Discussion

5.1 Pre-estimation Test

Using the Augmented Dickey-Fuller (ADF) Test for unit roots, the variables were tested for Unit Roots to determine Stationarity:

Variable	*t*-Statistic (5% level)	Stationary
D(S$NEER)	-1.945823	Yes
D(MS)	-1.946348	Yes
D(CPI)	-1.945903	Yes
D(BAL_P)	-1.945903	Yes
D(OIL)	-1.945903	Yes
D(ELEC_GEN)	-1.946447	Yes
D(GFCF)	-1.945823	Yes
D(IND_PROD)	-1.945823	Yes
D(MER_T)	-1.945823	Yes
D(ULC)	-1.946447	Yes
D(STI)	-1.945823	Yes

As all the variables were found to be stationary, next is to determine the Lag level for the Model. This was selected using the Schwarz Information Criterion (SIC):

Sample: 2000Q1 2016Q4
Included observations: 63

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4521.692	NA	8.62e+48	143.8950	144.2692*	144.0422
1	-4326.805	315.5309	8.70e+47	141.5494	146.0398	143.3155
2	-4146.609	228.8210	1.86e+47	139.6701	148.2767	143.0551
3	-3978.067	155.1658	1.14e+47	138.1608	150.8836	143.1648
4	-3713.071	151.4261*	1.57e+46*	133.5895*	150.4285	140.2124*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

As observed from the Lag Order Selection Criteria above, the Schwarz Information Criterion indicates that this Model has an Optimal Lag of 0.

Roots of Characteristic Polynomial
Endogenous variables: D(S$NEER) D(MS) D(CPI)...
Exogenous variables: C
Lag specification: 1 1
Date: 06/06/17 Time: 17:34

Root	Modulus
-0.053806 - 0.665473i	0.667644
-0.053806 + 0.665473i	0.667644
0.620409	0.620409
-0.575150	0.575150
-0.475721 - 0.282990i	0.553528
-0.475721 + 0.282990i	0.553528
0.154369 - 0.453371i	0.478931
0.154369 + 0.453371i	0.478931
-0.301318 - 0.102374i	0.318234
-0.301318 + 0.102374i	0.318234
0.218617	0.218617

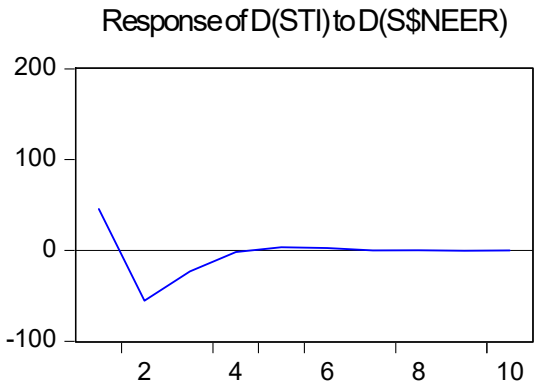
No root lies outside the unit circle.
VAR satisfies the stability condition.

As observed in the above VAR Stability Test, the Equation VAR Model for STI generated a range of modulus values that indicated this VAR Model is in a stable state. As such, Restriction Matrices A and B were imposed on the VAR model, and the SVAR model was constructed.

5.2 Impulse Responses

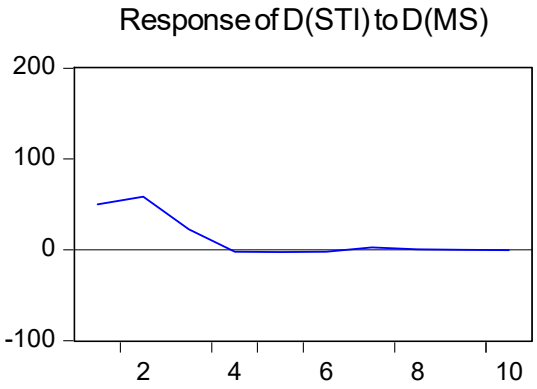
Impulse Responses using Cholesky (d.o.f. adjusted) was examined to determine the impact of the variables on the STI:

5.2.1 Impact of S$NEER on STI



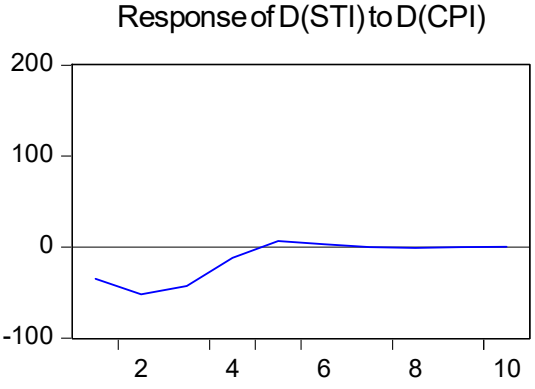
STI was found to respond negatively short-term to S$NEER, with a drop to -55% over 2 periods before values recover to 0%.

5.2.2 Impact of Monetary Supply on STI



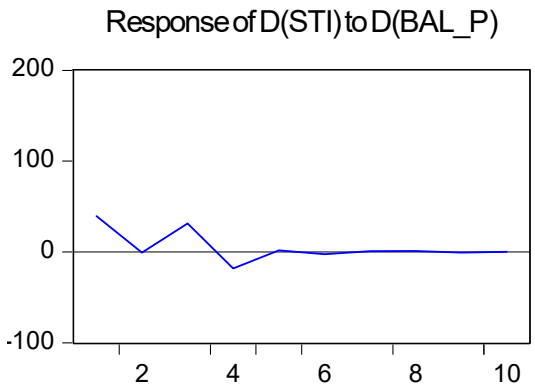
Monetary Supply was found to have a minor short-term positive effect on the STI, as STI levels rose up to 59% over 2 periods before recovering to 0%.

5.2.3 Impact of CPI on STI



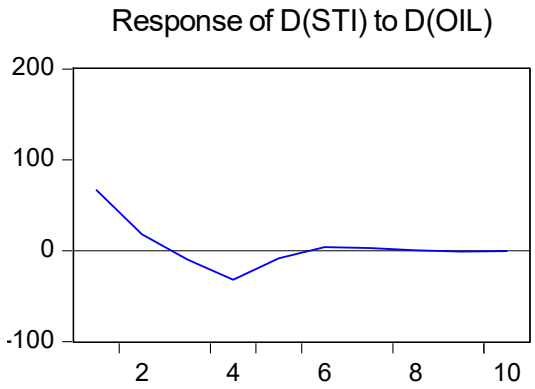
CPI was found to have a short-term negative impact on STI, as STI levels dropped to -52% levels over 2 periods before recovering to 0%.

5.2.4 Impact of Balance of Payments on STI



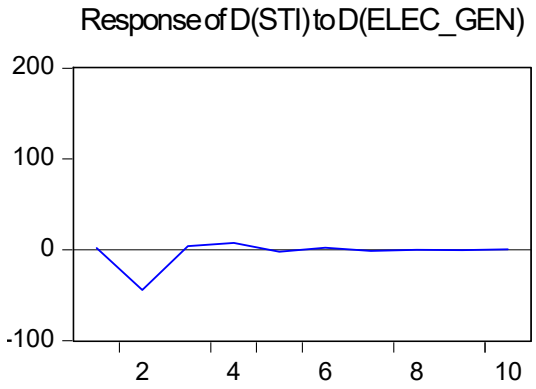
Balance of Payments was found to positively impact the STI in the short run, with STI levels overall rising to as high as 39% within 3 periods before eventual correction back to 0%.

5.2.5 Impact of Crude Oil Prices on STI



Crude Oil price was found to have a short-term positive impact the STI, with STI levels initially rising to a high of 67% initially, before dropping to a low of -32% in the 4th period, and eventually recovering to 0%.

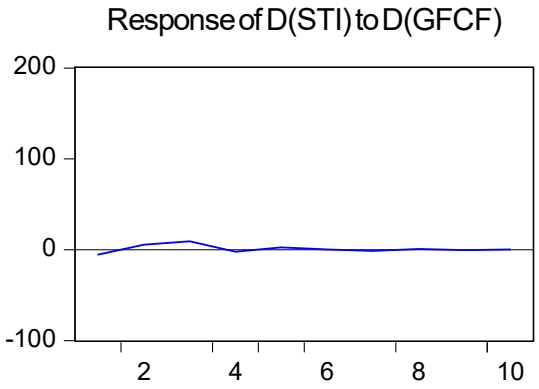
5.2.6 Impact of Electricity Generated on STI



Electricity Generated was found to have a short-term negative impact on the STI, given that

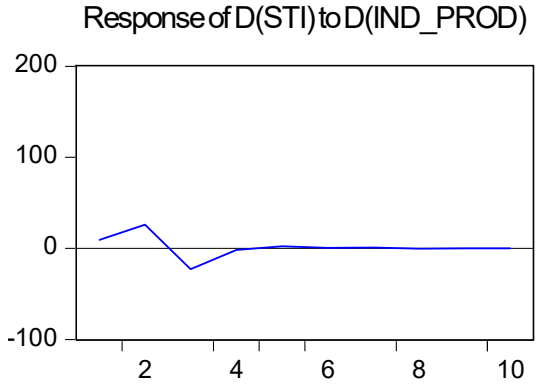
STI levels dropped to -44% over 2 periods before recovering to 0%.

5.2.7 Impact of Gross Fixed Capital Formation on STI



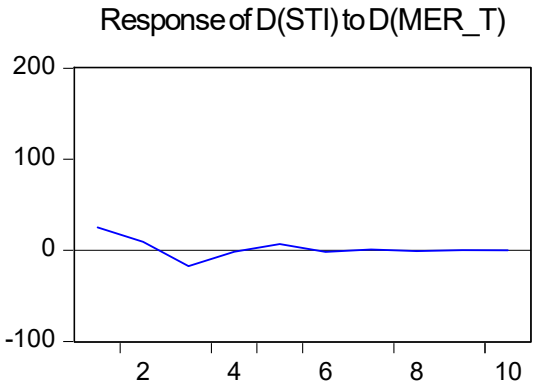
GFCF was found to have a positive short-term impact on the STI, with STI levels rising to 9% over 3 periods before recovering to 0%.

5.2.8 Impact of Total Industrial Production on STI



Industrial Production was found to have a positive short-term effect on the STI; the levels of which rose to 26% over 2 periods before eventual adjustments back to 0%.

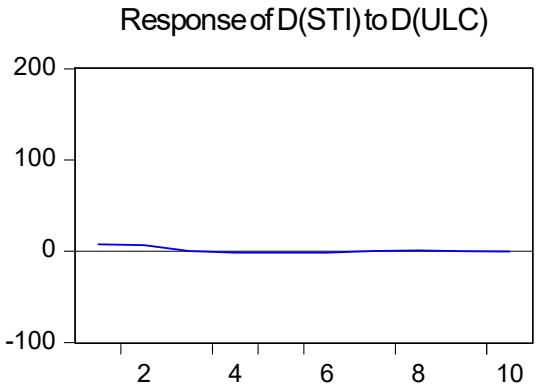
5.2.9 Impact of Total Merchandise Trade on STI



Merchandise Trade was found to have a positive impact on the STI in the short-run, with STI

levels initially spiking to 25% before eventual correction back to 0%.

5.2.10 Impact of Unit of Labour Cost on STI



The Cost of Labour was found to have a short-term positive impact on the STI, with STI levels rising to 7% over 2 periods before correction back to 0%.

5.3 Variance Decomposition

A Cholesky Decomposition was also carried out to determine the impact of the variables on one another. The measure of variance accountability was rounded off to the nearest percentage point:

Variable/ Due to	S$NEER	MS	CPI	Bal_P	Oil	Elect	GFCF	Ind_Prod	Mer_T	ULC	STI
S$NEER	*NA*	1%	8%	8%	3%	1%	3%	2%	2%	0%	1%
MS	11%	*NA*	3%	6%	5%	4%	2%	1%	4%	3%	1%
CPI	10%	10%	*NA*	0%	4%	3%	1%	1%	1%	6%	0%
Bal_P	2%	2%	1%	*NA*	1%	4%	1%	1%	0%	1%	4%
Oil	12%	3%	6%	2%	*NA*	1%	2%	1%	1%	1%	0%
Elect	9%	8%	3%	2%	4%	*NA*	1%	7%	1%	8%	4%
GFCF	7%	3%	1%	22%	1%	2%	*NA*	0%	3%	4%	2%
Ind_Prod	2%	2%	3%	10%	21%	7%	1%	*NA*	4%	2%	1%
Mer_T	5%	2%	5%	12%	7%	2%	2%	6%	*NA*	2%	2%
ULC	6%	10%	5%	5%	8%	20%	3%	3%	2%	*NA*	3%
STI	9%	10%	9%	4%	9%	3%	0%	2%	2%	0%	*NA*

5.4 Discussion

5.4.1 Hypothesis 1: S$NEER has a negative impact on STI

STI was found to respond negatively short-term to S$NEER, and it was found that approximately 9% of variance observed in the STI was attributable to the S$NEER. This means the strength of Singapore's Exchange rate, relative to its key trade partners, has a negative impact on its domestic Stock returns; accounting for about 9% of these returns. This

finding was in line with expectations. As previously discussed, although domestic currency appreciation implies a lower cost of importing goods, net exporting countries such as Singapore face an increasing demand in exports when the domestic currency depreciates, and vice-versa.

5.4.2 Hypothesis 2: Monetary Supply has a positive impact on STI

Monetary Supply was found to have a minor short-term positive effect on the STI, and it was found that approximately 10% of variance observed in the STI was attributable to Monetary Supply. This means Monetary Supply in Singapore has a positive impact on its Stock returns; accounting for about 10% of these returns. This finding was in line with expectations. Previous discussions on portfolio theory, where an increase in Money Supply leads to an increase in interest-bearing assets including stocks, and vice-versa; as mentioned by Chia and Lim (2015).

5.4.3 Hypothesis 3: CPI has a negative impact on STI

CPI was found to have a short-term negative impact on STI, and it was found that approximately 9% of variance observed in the STI was attributable to the CPI. This means Inflation was found to have a negative impact on Stock returns in Singapore; accounting for about 9% of these returns. This finding was in line with expectations; as discussed earlier with regards to findings in Alam and Rashid (2014), as well as Chia and Lim (2015).

5.4.4 Hypothesis 4: Balance of Payments has a positive impact on STI

Balance of Payments was found to positively impact the STI in the short run, and it was found that approximately 4% of variance observed in the STI was attributable to Balance of Payments. This means Government expenditure in Singapore has a positive impact on its domestic Stock returns; accounting for about 4% of these returns. This finding was in line with expectations. The significance of this positive impact was highlighted in the findings that Government expenditure explains approximately 10% of Industrial Production behaviour and 12% of Merchandise Trade behaviour, as well as about 8% of the S$NEER changes.

5.4.5 Hypothesis 5: Crude Oil Prices has a positive impact on STI

Crude Oil price was found to have a short-term positive impact the STI, and it was found that approximately 9% of variance observed in the STI was attributable to Crude Oil prices. This means Crude Oil prices have a positive impact on Singapore's Stock returns; accounting for about 9% of these returns. This finding was in line with expectations. As previously discussed, Singapore's Oil & Gas sector is significant to the local economy, and hence the significant and positive relationship (Ministry of Trade and Industry, 2017).

5.4.6 Hypothesis 6: Electricity Generated has a positive impact on STI

Electricity Generated was found to have a short-term negative impact on the STI, and it was found that approximately 3% of variance observed in the STI was attributable to Electricity Generated. This means Electricity Generated in Singapore was found to negatively impact Stock returns; accounting for about 3% of these returns. This finding was not in line with

expectations. It was, however, noted that Utilities costs to Singapore firms form anywhere from 3% to 29% of total costs (Ministry of Trade and Industry, 2017). Given so, electricity consumption in Singapore could possibly be in fact strictly a cost variable, not a positive indicator of economic activity; hence explaining the negative relationship.

Another possibility was the ongoing concern which was noted earlier, that there was the possibility that estimating the Dec 2016 figure skewed the data. However, estimation was only relevant to one of the 68 observations, which took into account the latest ongoing and seasonal trends. As such, likelihood of skewedness was kept to a minimal.

5.4.7 Hypothesis 7: Gross Fixed Capital Formation has a positive impact on STI

GFCF was found to have a positive short-term impact on the STI, and it was found that almost 0% of variance observed in the STI was attributable to the GFCF. This means the same drivers that lead to increases in fixed assets in Singapore also positively impacts Stock returns. This finding was in line with expectations. However, it was also found that GFCF does not explain changes in Stock returns. This could be possibly be explained acquisitions of fixed assets are for future benefits, for example business expansion, which in turn leads to a better present value valuation of a firm's stocks, and hence influencing Stock returns.

5.4.8 Hypothesis 8: Total Industrial Production has a positive impact on STI

Industrial Production was found to have a positive short-term effect on the STI, and it was found that about 2% of variance observed in the STI was attributable to Industrial Production. This means Industrial Production positively drives Stock returns in Singapore; accounting for about 2% of such returns. This finding was in line with expectations, validating Industrial Production as a reliable indicator of economic strength (Ministry of Trade and Industry, 2017).

5.4.9 Hypothesis 9: Total Merchandise Trade has a positive impact on STI

Merchandise Trade was found to have a positive impact on the STI in the short-run, and it was found that approximately 2% of variance observed in the STI was attributable to Merchandise Trade. This means Merchandise Trade positively influences Stock returns in Singapore; accounting for about 2% of these returns. This finding was in line with expectations, validating Industrial Production as a reliable indicator of economic strength (Ministry of Trade and Industry, 2017).

5.4.10 Hypothesis 10: Unit of Labour Cost has a negative impact on STI

The Cost of Labour was found to have a short-term positive impact on the STI, and it was found that nearly 0% of variance observed in the STI was attributable to the Unit of Labour Cost. This means the same driver of rising labour costs also impacts Stock returns in Singapore in the same direction. This finding was not in line with expectations. One explanation for this discovered positive relationship is that as a net exporter, a significant proportion of the money used to pay for labour costs in Singapore comes from the foreign trade partners. As such, the higher the Unit of Labour Cost, the greater the amount of money in circulation in Singapore (i.e. M1 of Monetary Supply), which has a positive impact on

Stock returns in Singapore. This also possibly explains why labour costs do not directly explain changes in Stock returns; as the impact it has is indirect via Monetary Supply. This also possibly explains the manner in which labour costs explain about 3% of the changes in Monetary Supply.

5. Limitations and Further Research

This Research did not take into consideration the impact that the selected macroeconomic variables had on individual sectoral stock indices; with reference to the Methodology employed by Kurniawati et al. (2016), and in doing so, that study was able to utilize their SVAR Model to obtain a more informed insight into how macroeconomic variables impacted the different sectoral indices, which in turn impacted the overall Jakarta Composite Index.

Having employed an SVAR Model, this Research's Methodology utilized certain assumptions with regards to the structural restrictions being placed on the unobserved structural innovations in the SVAR Model (i.e. u_t). The B Matrix applied to u_t was a square ($k * k$) Matrix; riding on the assumption that the number of equations in the matrix is equal to the number of orthonormal disturbances (Amisano and Giannini, 1996; Gottschalk, 2001). As such, there is the possibility that not all orthonormal disturbances this Model faced were explained. Further research could be done to account for more of these shocks to the Model.

In addition, when using the Straits Times Index as a measure for stock returns, not the entire Singaporean stock market was taken into account. The STI measures only the top 30 stocks in the market, and these individual stocks could have been replaced over time; hence making it an unreliable measure of stock returns in Singapore overall (FTSE Russell, 2017). The alternative, however, would have been to use the FTSE-AllShare, which takes into weighted account approximately 86% of the entire domestic stock market (FTSE Russell, 2017). However, the AllShare would have also taken into account shares that have little to no movement in spite of changes in the macroeconomic environment; resulting in skewed data. Further research can be carried out looking into which Index would be more a more reliable measure for the purposes of research in areas such as this. To add to this point with hindsight, future research could possibly entail acquiring and analysing the prices of the individual stocks or sector, as opposed to indices, for a higher likelihood of more reliable data.

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